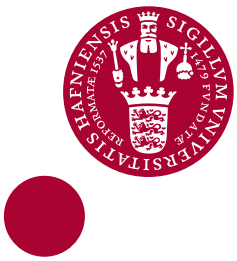

When actions have no consequences

Rewards in visual search and the role of contingencies

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When actions have no consequences:

Rewards in visual search

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Introduction

- Hickey *et al.* (2010a,2010b,2011) reported an intriguing ***reward-priming*** effect, in a task in which correct responses were rewarded with a ***randomly determined*** high or low monetary ***reward***
- **Main finding:** a correct response to a target, which coincidentally resulted in ***high-reward***, ***sped up responses*** on a subsequent trial if the color scheme of targets was held constant on consequtive trials. If the color scheme changed, this would result ***slower responses***
- The effect was dependent on a ***"surprising"*** irrelevant color singleton.
- What is most interesting about the result is how the visual system seems able to ***rapidly prioritize a feature that co-occurs with reward.***
- Intuitively, such plasticity seems counterproductive, since the world and its feature-reward associations are rather stable.

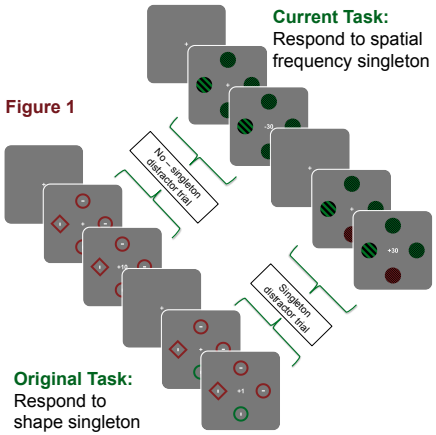
Current Aims

- To ***reproduce*** the effect in an analogous - but superficially different - search task
- To test the ***role of the "surprising" singleton***
- To test the contribution of ***motivational factors***

Compare two visual search paradigms

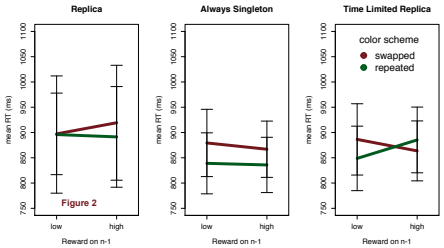
- In each experiment, 8 observers were presented with a ***Gabor*** version of the original search task (figure 1)
- The ***target-defining*** feature was always ***spatial frequency***
- Stimulus ***colors*** were always ***irrelevant*** and ***non-predictive*** of reward
- The dependent measure was ***reaction time*** on correct trials.

Figure 1



- **Three test conditions:**
  1. A close ***replica*** of the original task
  2. A version with an ***ever-present irrelevant singleton***
  3. A ***time limited*** version of the replica to encourage optimized – rather than conservative - response strategies.

Results



- The replication attempt ***did not*** yield any significant effects (p's >0.3), although the descriptive ***pattern is consistent with reward priming*** (Figure 2, left panel)
- When the irrelevant singleton was always present in the display, there was a marginally significant color priming effect (p = 0.057) but no effect of reward or *reward × color* interactions (p's > 0.46; figure 2, middle panel)
- In the time limited condition - where observers had a finite interval to earn as much money as possible - there was a ***significant reward × color interaction*** (p = 0.033). However, ***this was the mirror image of the expected reward-priming interaction***. Other effects were not significant (p's > 0.54; figure 2, right panel)
- There were huge individual differences (see figure below). Therefore, it's doubtful whether it makes sense to interpret the data based on collapsed averages

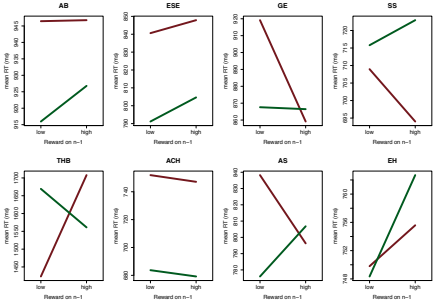


Figure 3. The averages for each observer in the *replica* experiment. There were similar between-subject variations in the other experiments.

Conclusions

- It is not trivial to re-produce reward-priming effects stemming from non-contingent reward schemes.
- The averaged results from the ***replica*** experiment are similar to the Hickey *et al.*(2010b). However, in the present study the pattern is an ***artifact of averaging***. No Observer shows this response pattern.
- ***Reward can influence selection*** in a more predictable manner (Anderson *et al.,* 2011, Kristjánsson *et al.,* 2010) when reward is ***contingent on visual features***.
- The most interesting and stable effects are probably to be found by using ***behavior-*** or ***visual feature - contingent*** reward schemes.
- It is necessary to consider whether the experimental design ***encourages a conservative strategy*** that works against the dependent measure: ***reaction time***; and whether ***this may be the cause of reward-priming.***

References:

Anderson, B. A., Laurent, P. A., & Yantis, S. (2011). Value-driven attentional capture. Proceedings of the National Academy of Sciences, 108(25), 10367–10371.
Hickey, C., Chelazzi, L., & Theeuwes, J. (2010). Reward Changes Salience in Human Vision via the Anterior Cingulate. *Journal of Neuroscience, 30*, 11096–11103.
Hickey, C., Chelazzi, L., & Theeuwes, J. (2010). Reward Guides Vision when It's Your Thing: Trait Reward-Seeking in Reward-Mediated Visual Priming. *PLoS ONE, 5*, e14087.
Hickey, C., Chelazzi, L., & Theeuwes, J. (2011). Reward has a residual impact on target selection in visual search, but not on the suppression of distractors. Visual Cognition, 19(1), 117–128.
Kristjánsson, Á., Sigurjónsdóttir, Ó., & Driver, J. (2010). Fortune and reversals of fortune in visual search: Reward contingencies for pop-out targets affect search efficiency and target repetition effects. Attention, Perception & Psychophysics, 72(5), 1229–1236.

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